



No deal in space: A bargaining model analysis of U.S. resistance to space arms control

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ABSTRACT

Space systems are essential to the global economy and security. The possibility of disruptions arising from competition between the United States and China through the testing and deployment of weapons in space has led to concerns over an incipient space arms race that would threaten satellites, leading to international calls for a space arms control treaty. The paper presents a rationalist theory analysis on the lack of progress in establishing such a treaty, identifying the United States' position of primacy in the global order and its preeminence in space as a primary cause.

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Space is essential to the global economy and international security. The United States currently holds an advantageous position in space exploration and use, granting it great economic and security benefits. Yet space is increasingly becoming more "congested, contested and competitive" as more states and non-state actors become capable space players each pursuing their own interests. In the coming years the United States will have the opportunity to define how space is used for military purposes beyond surveillance, communications, targeting and navigation as it seeks to guarantee its security interests and to gain an undisputed position of space superiority, possibly deploying weapons in space (thus "weaponizing" space) to defend its satellites and project power through and from space, to preserve its primacy [1]. This position of space superiority can be understood as the use by the United States of the "commons" of space unrestricted, including being able to deny and defeat any challenges to its use by any other state and non-state actor [2].

Potential U.S. adversaries have noted America's dependence on space and the vulnerability of these systems, calling it America's "Achilles' heel." [3]. In January 2007 China shot down one of its own satellites with a modified ballistic missile. This anti-satellite (ASAT)

test was interpreted by many analysts as a signal to the United States not to pursue any plans in dominating space [4]. While actions from other notable space players, such as Russia, the European Union, and India, as well as Iran and North Korea, impact space security, the possibility of disruptions arising from competition between the United States and China through the testing and deployment of space weapons has been considered the most concerning and at risk of triggering a space arms race, leading to international calls for a space arms control treaty.

Since the United States' space power [5] is essential to economic prosperity and security, and considerably dependent on satellites, and that these satellites are highly vulnerable to any disruption, why isn't the United States attempting to secure its position with a space arms control agreement that would eliminate such a threat? The objective of this article is to present an analysis based on James D. Fearon's "rationalist explanations for war" theory on the lack of progress in negotiating and establishing a space arms control treaty [6].

The first part of the article presents the United States' interests in space and how it relates to its primacy noting the challenge of a rising China. The second part presents the U.S.–China rivalry as the basis of the article's analysis on space weapons. The third part presents various models outlining the U.S. and Chinese negotiating positions to demonstrate how American primacy hinders the establishment of a space arms control agreement. The fourth and

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final part summarizes the article's findings and presents concluding remarks.

1. The United States at a crossroads

The United States remains unrivaled in overall power. Its military, political, economic and cultural power makes it the preeminent state. With the use of satellites the United States has been able to not only enhance its economic dynamism, but also project military power across the globe. Of the 1046 operational satellites currently in orbit the United States owns and operates 455 [7]. The United States is the preeminent space power. But as it is highly dependent on space, it is also vulnerable to any disruptions to these systems [3].

As a 2001 Congressional report on U.S. space security interests affirmed, a surprise attack on U.S. satellites, a "Space Pearl Harbor", could have disastrous consequences not only on economic activities, but especially on the U.S. military's ability to act quickly and efficiently throughout the world [8]. Although critics of the report considered the threats overblown, the report did raise awareness on U.S. dependence on space and pushed policymakers into considering the defense of these systems a priority, with any threats to it requiring U.S. responses, most notably during the George W. Bush administration [9]. Depending on how the United States perceives emerging threats, formulates objectives and means, U.S. actions, as the preeminent power, will strongly influence the dynamics of international and space security. It faces a crossroads and dilemma in "how to establish a secure international environment in outer space that will protect U.S. interests, as well as those of its allies and future generations." [10].

As the world transitions from the immediate post-Cold War unipolar world to one more "multipolar" in which the United States remains "first among equals" because of the disparity in overall power capabilities, but increasingly encounters limits to its influence and due to more capable states defending their own interests and pursuing different agendas. Many states have been "catching up" with the United States on many measures of power, with one in particular standing out: China.

The United States' current GDP is \$14.5 trillion, about 23% of world GDP, while China, with the second highest GDP of \$6 trillion accounts for 9.5% [11]. China has presented astonishing growth rates but it will still be years before it is able to catch up with the United States. Various studies have been presented forecasting when the Chinese economy would surpass the United States' economy, many reducing forecasts to as early as 2019 [12]. As Joseph S. Nye, Jr. noted, China may one day match the United States' gross domestic product, becoming "equivalent in size, but not equal in composition." [13]. The United States still fares better in terms of national competitiveness, ranking 7th in the World Economic Forum's *Global Competitiveness Report 2012–2013*, while China ranked 29th [14]. As Fareed Zakaria noted, the United States presents other advantages China lacks, such as a highly developed higher education system (that translates into technological and economic innovations) and demographic trends in its favor brought about by immigration that further enhances its economic development [15].

Much has been debated on China's rise and its interests and views on the continued primacy of the United States, the preservation of the current international order, and the role China sees for itself in the world [16]. In the short term, China is concerned over any U.S. interference in a conflict over Taiwan. In the long term, geopolitical rivalry with the United States impels China to invest in greater military capabilities.

Challenging the United States through conventional means is difficult and economically daunting [17]. Current U.S. defense spending is about \$711 billion, about 41% of total world spending.

China accounts for 8.2%. If any state wishes to challenge the United States alone, it would find the effort to be quite daunting. U.S. conventional power is so overwhelming that adversaries must seek alternatives to confront the United States, either through "asymmetric warfare" or the pursuit of weapons of mass destruction [18]. Since China cannot match U.S. conventional power, it has an incentive in developing asymmetrical alternatives to deny U.S. advantages, including in space, such as with the development of space weapons. Space is not yet "weaponized," meaning no nation can launch direct attacks from space against other space based platforms (other satellites), or even to the surface of the Earth [19].

As technological advances make space activities more accessible and cheaper, space increasingly becomes an area of dispute among nations. Any state determined to challenge the United States will have to counter the advantages granted to it by its space assets, including possibly the resort to military means [20]. These states may seek asymmetrical tactics to limit U.S. space advantages, instead of trying to match U.S. space power satellite by satellite, with the use of space weapons [21]. Therefore the United States' current position of space superiority, like its earthly global primacy, may not be the same in the coming decades.

In January 2007 China shot down one of its aging weather satellites using a missile, clearly demonstrating an ASAT capability. Analysts interpreted the Chinese test as a signal to the United States, a demonstration that China would be able to affect U.S. military effectiveness by destroying its space based advantage, and an incentive to reconsider any intentions in weaponizing space and triggering a space arms race in its pursuit of preserving U.S. space superiority [22]. There are indications that China has also been seeking other means of limiting or even denying U.S. space advantages, researching ground based lasers and other energy weapons, and electronic jammers capable of affecting American satellites [23].

Many analysts debate if China's testing of space weapons capabilities is an inevitable response to the United States and an inherent dynamic of great power competition. China's counter-space programs are linked to its objective in limiting the United States' superiority in conventional forces, especially air force and naval forces which operate in China's vicinity [24].

The United States' concern over its primacy extends to its favorable position in space, and of possible challenges to it, reflecting the concern of a return to great power politics in the near future. The choices the United States make now in space may help it to secure a long term favorable position or risk an acceleration of competition with potential rivals. American initiatives in space would seek to establish firmly U.S. space advantages and contain an adversary's emerging space capabilities that would allow it to challenge U.S. primacy more easily [19]. Some notable developments indicate the United States' interest in preserving its space superiority, such as the United States' own ASAT test in 2008, with the launch and testing by the U.S. Air Force of the X-37 unmanned space plane in 2010, 2011 and 2012, whose mission is classified, raising suspicions and concerns over its military applications [25].

The use of missiles to destroy satellites, the only currently proven ASAT capability, if ever employed widely, would create a large quantity of space debris [22]. As space debris orbits the Earth at extreme velocity, it endangers other satellites and manned space missions. Even the smallest piece of debris can cause great damage. A hit by a small fragment, even centimeters long, has the potential of seriously damaging satellites and other manned spacecraft [26]. Space debris itself is already a threat and can become a greater threat with the unrestricted use of certain space weapons.

Since space debris threatens and can harm all space-faring nations' satellites, including the nation that decides to test or launch

an attack with debris generating ASAT weapons, there is a major incentive to limit the deployment and use of such weapons. The United States, with the greater number of satellites and dependence on space, would have much more to lose if space weapons were widely tested, proliferated, and employed without restriction, jeopardizing the unique power it derives from space. Thus the United States should have enough incentives to either curb such developments or promote initiatives that would shift trends away from such a scenario, yet it does not. Why is the United States not cementing its position with an ASAT treaty? Why does it resist any space arms control agreement?

The following section presents an evaluation of the current state of affairs on space weapons. It will focus on the competition between the United States and China, defining each country's negotiating positions as represented by various groups and their views on space weapons and national interests.

2. Space weapons choices

In analyzing possible scenarios on space weapons, the analysis presented has as its two main actors the United States and China, the country most likely to contest any American moves in weaponizing space. Considering the anarchic nature of the international system, the initial choices presented in this analysis are to develop and place weapons in space or develop capabilities that counter its opponent's space based advantages to defend their security and power positions. They can also not respond and yield to the other, a less than preferable outcome.

Both actors are aware of the other's actions; a move by one is noticed by the other. The level of development of all offensive and defensive space systems may not be completely clear to the other (such as the extent of China's ability to disable American spy satellites by "dazzling" or "blinding" them with directed energy weapons, or the United States' classified space weapons programs), but both currently are confident of the other's ASAT capabilities with the use of modified ballistic missiles and disruptions from electronic jamming capabilities [27].

Issues of verification, domestic politics, and actions by other state and non-state space actors are not analyzed in depth in this initial analysis, although they can be reflected in shifting the various negotiating positions in both countries. For example, proposals of various verification measures can either weaken or strengthen the pro and anti-space weapons camps in the U.S., or the role of private commercial enterprises and their lobbying efforts may lead to a strengthening of supporters for a more cautious approach to weaponizing space.

Space security does not depend exclusively on the United States and China, but at the moment these are the space players that most impact the space weapons issue, and international concern and academic debate are focused on the perceived geopolitical rivalry between the two. They have most recently tested and demonstrated ASAT weapons capabilities and have policymakers (both civilian and military) who have declared their countries' interests and freedom to act in space will not be threatened.

In a possible confrontation using space weapons, military satellites would be primary targets. Proven ASAT systems have been able to destroy targets in low earth orbit (LEO, from 80 km up to 2000 km above Earth). China's 2007 ASAT test destroyed a satellite at 865 km and the United States' 2008 ASAT mission destroyed its target satellite at 247 km. GPS satellites orbit at 20,000 km in medium earth orbit (MEO, between 2000 km and 36,000 km above Earth). Communications and weather satellites "hover" over a specific area of the globe 36,000 km above Earth in geosynchronous earth orbit (GEO). With more powerful missiles these satellites could also eventually be threatened (See Table 1).

Table 1
U.S. and Chinese satellite distributions by orbits.

	United States	China
LEO	237 (42)	64 (13)
MEO	32 (32)	5 (5)
GEO	172 (47)	38 (17)
Elliptical	14 (7)	0

The numbers in parenthesis indicate the number of military satellites from the total in each orbit.

Source: Union of Concerned Scientists Satellite Database (12/1/12).

Considering the Chinese ASAT test in 2007, space weapons advocates argue the United States has incentives for weaponizing space while it still has the technological and space power lead. China can develop space systems to limit whatever advantages the United States currently have regarding space based systems, or develop and deploy its own offensive space based capabilities.

Yet U.S. assumptions about China as a rival risk becoming a self fulfilling prophecy. Chinese behavior and actions have reinforced the view as a new rival and raise concerns among U.S. policymakers. If a crisis over Taiwan ever forced China to strike at U.S. satellites, how would the United States respond? [28] Would counter strikes on Chinese ASAT ground based launchers deep within Chinese territory be interpreted as acceptable responses or would they lead to escalation and full scale war? Would China be deterred from striking U.S. satellites if it was aware this was U.S. policy? There is a need for greater dialog between the two countries so as to avoid unnecessary tensions, increase understanding of interests, and decrease competition in space [29].

Can a negotiated settlement, a "bargain," over space weapons be achieved? An analysis based on James Fearon's "rationalist explanation for war theory" is presented in the next section which offers insights into the current distribution of space power and the possibilities of conflict between the United States and China, and the difficulties in establishing an agreement on space weapons.

3. Modeling a bargain on space weapons

The basic setup of a rationalist or bargaining model outlines two states, A and B, whose preferences lie in an interval X , where 0 is State B's ideal outcome and 1 is State A's ideal outcome. On this interval " x " is the current distribution of power or good being disputed, and " P " the expected payoff (or new distribution of power or good in dispute) if both states go to war. The model posits that war is costly, thus for both states the expected payoff will be adjusted for costs in going to war, reducing the benefits initially predicted. Thus State A's costs would be " a " and State B's costs " b " [6].

In the basic setup of the model above (Fig. 1) the status quo " x " is unstable since State A expects to improve its situation to point P by resorting to war, but after costs are included from going to war, the expected position is point " $P - a$ " (still a situation more favorable to State A). State B on the other hand will see its position greatly eroded because the situation will shift from " x " to a point much farther from its ideal point (after costs of war for State B are calculated, it will be at point " $P + b$ ").

Considering these costs, both states may wish to avoid war and attempt to reach a compromise short of war. Thus the model affirms both states would have preferences on a bargain that is less costly than going to war. State A would prefer any outcome short of its cost of war to its ideal point, and State B any outcome short of its cost of going to war to its ideal point, as modeled in Fig. 2.

The overlap of these preferences is the bargaining range, where both states could resolve the issue through a negotiated settlement

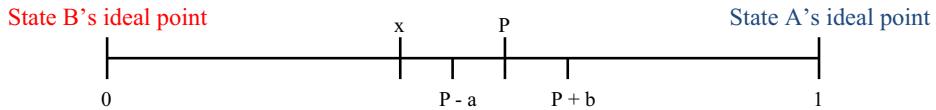


Fig. 1. Bargaining model – basic setup.

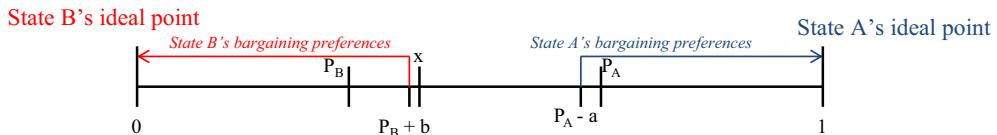


Fig. 2. States' bargaining preferences.

without resorting to war. A negotiated deal would emerge between points “ $P - a$ ” and “ $P + b$ ”. State A would push for a bargain closer to point “ $P + b$ ” and State B would push for a deal closer to “ $P - a$ ” (see Fig. 3).

War, according to rationalist theory, is the result of a failure of bargaining. It should be noted that states could view their payoffs (“ P_A ” and “ P_B ”) and costs (“ $P_A - a$ ” and “ $P_B + b$ ”) differently, leading to situations in which no bargaining range is possible (there is no overlap of preferences), or each state has incentives in striking first, that is, waging preventive war, in order to secure its new better position along the interval before its rival takes action (as seen in Fig. 4).

The issue of space weapons and negotiating a space arms agreement can also be analyzed through a bargaining model. The two competing states would be the United States and China. The United States currently presents a greater advantage in terms of global and space power. The assumption by many analysts is that space weaponization would be more costly to the United States. Its military and economic power is highly dependent on satellites, it possesses more satellites than any other state, and it is more vulnerable to disruptions to its space infrastructure. The United States should have great interest in limiting testing and deployment of space weapons, especially debris generating space weapons. Therefore a bargain should be possible.

The problem or puzzle that emerges from this situation and assumptions is why does the United States resist a space arms control agreement? The hypothesis is that the United States’ pursuit of, and attempts to preserve its primacy, allows it to resist any space arms control agreements, benefiting from the lack of an agreement.

The initial setup of the model would present the current situation with the status quo as no arms control agreements in place and an advantage to the United States in terms of space power, favoring the United States (point SQ is closer to the United States’ ideal point). This favorable position for the United States is due to its greater number of satellites in space compared to China (see Table 2), but especially how it leverages the use of these systems to enhance its military, political, economic and cultural power relative to other states.

The United States’ “ideal point” can be understood as uncontested use of space, with no other states able to threaten its satellites. As stated in the “National Space Policy of the United States of America” of 2010, “The United States considers the space systems of all nations to have the rights of passage through, and conduct of operations in, space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation’s rights.” [30]. Ideally, these rights could never be infringed if other states, especially rivals, lacked the capability to threaten satellites.

In “China’s Space Activities in 2011,” a Chinese government statement outlining China’s five year space plan, it is noted: “Peaceful development. China always adheres to the use of outer space for peaceful purposes, and opposes weaponization or any arms race in outer space. The country develops and utilizes space resources in a prudent manner and takes effective measures to protect the space environment, ensuring that its space activities benefit the whole of mankind.” China’s “ideal point” can be considered the same as the United States – freedom of use of satellites without any threats from rival states – but with Chinese

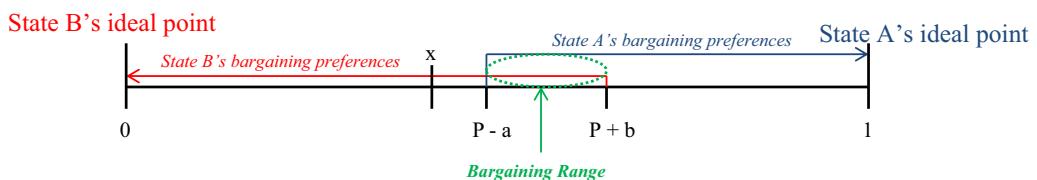


Fig. 3. The bargaining range.

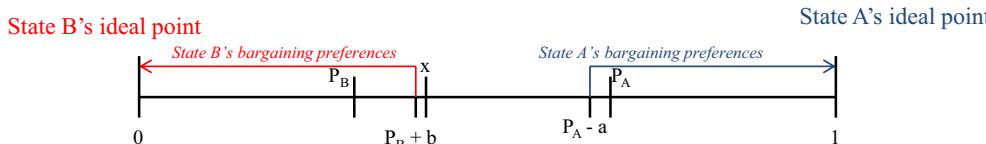


Fig. 4. Different payoff perceptions and first strike incentives.

Table 2

Satellite types operated by the United States and China.

	United States	China
Civil	11	5
Commercial	200	12
Government	116	55
Military	128	35
Total	455	107

Source: Numbers compiled by author, Union of Concerned Scientists Satellite Database (12/1/12).

space dominance instead of the United States. The model's initial setup with these ideal points is illustrated in Fig. 5.

U.S. proponents of space weaponization argue that if the United States weaponizes first, it can further enhance the United States' position in space (point " P_{USA1} "), pushing its position beyond the status quo towards its ideal point. They argue space weapons would allow the United States to confront any emerging rivals that attempted to challenge it and help preserve U.S. primacy [10].

Such views affirm the need for the United States to invest in space military capabilities that would enhance the disparity in power to the point of dissuading adversaries from even trying to compete [31]. Some U.S. policymakers agree with the proposition that "The United States has the ability to embark on a program to weaponize space, and [...] it should. If the United States enters this territory first and secures space, it could continue to provide peace and security on Earth and in the heavens." [32].

The United States' 2006 unclassified U.S. National Space Policy emphasized it would "preserve its rights, capabilities, and freedom of action in space; dissuade or deter others from either impeding those rights or developing capabilities intended to do so; take those actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities hostile to U.S. national interests." [1]. This declaration was understood at the time as including the option of developing and deploying space weapons.

Opponents of space weaponization argue that the costs of space weapons are too high, that countermeasures could be achieved more cheaply by adversaries (countering the benefits of space weapons), and certain objectives pertaining to the protection of space interests can be obtained through other options [10]. As Michael Krepon notes:

U.S. programs will cost more and be far more sophisticated than the ASAT weapons of potential adversaries, who will opt to kill satellites cheaply and crudely. The resulting competition would endanger U.S. troops that depend on satellites to an unprecedented degree for battlefield intelligence, communication, and targeting to win quickly and with a minimum of casualties [33].

Others have noted that the introduction of space weapons would have great destabilizing effects on security situations. As space based weapons would be "high-value but highly vulnerable military assets" this would lead to a "use it or lose it" mentality," leading to quick escalation in any crisis [34]. These analysts and policymakers consider space weaponization a negative outcome for the United States, thus pushing it further away from its ideal point

(to " P_{USA2} ") and worse relative to the status quo. These two U.S. positions, for weaponization (point " P_{USA1} ") and against (point " P_{USA2} "), can be seen in the model in Fig. 6.

However, bargaining theory posits that there are inherent costs associated with any actions that would actually place the outcome short of the projected benefits. As the most dependent user of space systems, the United States would have its position harmed with weaponization as it would lose more satellites and have sections of space unusable if space weapons were widely employed, especially debris generating ASATs [10].

These opponents are critical of U.S. actions which would lead to others developing space weapons and initiating a space arms race, another outcome the United States would want to avoid [34]. Just the testing of space weapons, such as the Chinese ASAT test generated over 35,000 pieces of debris of 1 cm or larger, a debris field that now threatens over 700 spacecraft in low earth orbit, including human spaceflight missions [35].

Thus for opponents of weaponization, the actual costs to the United States (" a ", where $[a1] > [a2]$) would be even worse than their expected payoff due to other greater unintended consequences, such as increased orbital debris harming economic activity or loss of prestige among allies (thus " $P_{USA2} - a2$ "), as represented in Fig. 7.

Advocates of weaponization on the other hand may recognize the costs of weaponization (point " $P_{USA1} - a1$ "), such as the loss of satellites, but ultimately believe the United States would still be better off, improving its position relative to the status quo because U.S. capabilities would be able to overcome any adversary:

these weapons' value will lie in their power for deterrence. If the kinetic option is ever employed, it will be with due diligence and consideration for the security of the globe as a whole. In the end, the United States is the only state that will be able to wield the power rationally and with the reasonable assurance that this power will be used judiciously for global security [32].

The model in Fig. 8 reflects U.S. space weaponization supporters' views on costs and expected outcomes.

Some Chinese analysts and policymakers believe China would be able to counter U.S. space power, degrade the United States' ability to act unrestrained, and improve China's position by investing in its own space capabilities and possibly space weapons. Some analysts project greater benefits (point " P_{C1} ") while others recognize the benefits but are more cautious (point " P_{C2} ").

Since the 1990s Chinese analysts envision space weapons as a necessary element that would allow Chinese military forces to counter the United States asymmetrically, noting "These approaches include disabling a more powerful navy by attacking its space-based communications and surveillance systems and even attacking naval units themselves from space." [36]. As Shu-Hsien Liao notes "[China] no longer wishes to leave the U.S. unchallenged in the use of space in any potential conflict or war in the Taiwan Straits, nor in any other conflict it may become involved in." [24].

These analysts believe China has more to gain from weaponization. It can be argued that China has less to lose than the United States because it lacks the same level of dependency on space

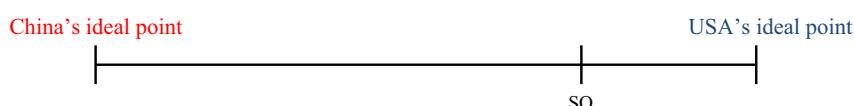


Fig. 5. Current balance of space power between the United States and China.

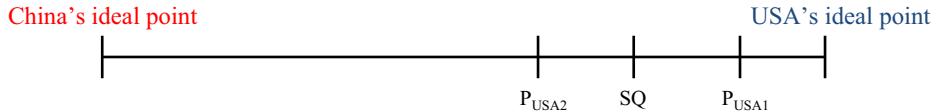


Fig. 6. Payoffs according to U.S. Space weapons proponents and opponents.

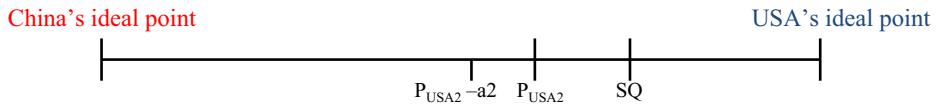


Fig. 7. U.S. space weapons opponents' cost of war.

systems as the United States has, and also believing it would be able to degrade the United States' military capabilities by striking American satellites, thus it perceives its costs ("b", where $[a1] > [a2] > [b2] > [b1]$) as lower than that of the United States.

However, some Chinese analysts have noted that the United States could adopt a strategy of "strategic misdirection," that is, forcing China, much like the Soviet Union before it, into increasing its defense budget and forcing its collapse: "The Western forces are attempting to drag China into the mire of the arms race. The United States is planning to pursue a TMD [theater missile defense] system..., so that the Chinese will step into the shoes of the former Soviet Union. In an arms race with the United States, China will consume its national power, and collapse without a battle." [37]. Space weapons would be an ideal "misdirection" that could force China into expending valuable resources that could be better employed in other endeavors.

Also, weaponization goes counter to China's international position on peaceful uses of space. There was widespread international outcry when China conducted its 2007 ASAT test and considerable embarrassment from the backlash in regards to the amount of debris generated and endangering of satellites. This went counter to the image China has invested in into being a responsible international actor. If it was to develop space weapons it would degrade its international standing, and also raise suspicion among its neighbors, such as Japan, India, Russia and South Korea, possibly forcing these neighbors to develop their own capabilities to balance China.

Considering costs, with space debris, loss of prestige, and increased regional competition and tensions, China could be worse off ($P_{C2} + b2$) worsening its position relative to the status quo. Or its gains from weaponizing would be marginal ($P_{C1} + b1$) only improving slightly its situation relative to the status quo, as demonstrated in the model in Fig. 9.

However, China's rise and improving power relative to the United States may eventually push its capabilities beyond that of its current position, altering the expected outcomes more favorably to China (P_{CF}) and less to both of the United States' expected outcomes (P_{USA1} and P_{USA2}), as demonstrated in the model in Fig. 10.

The shift in China's future expectations (P_{CF}) is greater in this future scenario because its space power would increase along with China's overall power. Since 2011 China has conducted more orbital launches than the United States (see Fig. 11). It is increasing its number of satellites for both commercial and military use which demonstrates China's ambition and role in its continued rise and enhanced space power.

Some analysts have noted that China's space capabilities have been improving considerably, enhancing its reconnaissance and intelligence gathering capabilities, which would allow it to leverage greater power projection in its near abroad, especially maritime operations [38].

Another notable development has been China's implementation of its own navigation system, Beidou, rivaling America's GPS. When fully deployed, China will no longer be dependent on the United States' GPS, allowing the Chinese military an independent and greater capability for precision weapons [39].

These differing views by the United States and China on expected outcomes of the benefits and costs of weaponizing space permit an analysis of the possible negotiated settlements, or bargains, which would be acceptable to both.

Weaponization opponents view two possible bargaining ranges between the United States and China based on the current distribution of power and expected outcomes. One in which weaponization is shunned and great costs are recognized by both sides, be it in terms of military expenditures and increased space debris which would harm economic activity and other benefits derived from

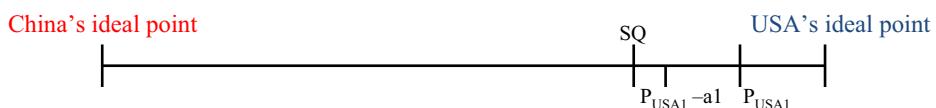


Fig. 8. U.S. space weapons proponents' cost of war.

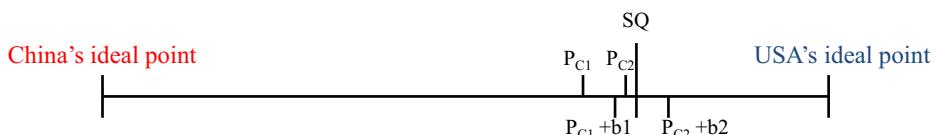


Fig. 9. China's views on space weaponization – payoff and costs.

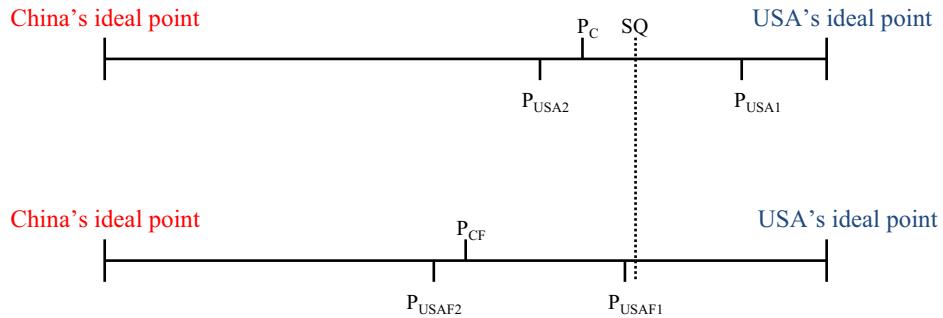


Fig. 10. Future distribution of power and expected outcomes.

satellites, thus the possibility for a negotiated settlement is much broader (bargaining range “BR1”), as seen in Fig. 12.

A second bargaining range (“BR2”) is narrower and takes into account China’s lower cost perception (due to lower dependence on space systems compared to the United States) in case of conflict, and seeks to accommodate China’s rising power because of a shifting power distribution and as a means of reducing the perception of the United States as threat to Chinese interests, as seen in Fig. 13.

This second bargaining range places the United States in a position “worse” than the status quo, but takes into account China’s rising power and seeks to accommodate its interests, reducing the possibility of conflict. There would be resistance and possible widespread lack of support for ceding U.S. advantages in such a bargain with China. There may be a bargaining range, but not one that the United States deems beneficial. Therefore U.S. space weapons advocates and proponents of continued U.S. primacy see no bargaining range as there is no overlap of preferences, as demonstrated in Fig. 14 (as they view the U.S. point of departure as $P_{USA1} - a1$ and view the Chinese position as also being aggressive, $P_C1 + b1$).

Two of the models presented previously indicate the possibility of cooperation and the establishment of an agreement, but also one of conflict, yet neither state has engaged in widespread space weaponization. Neither has announced space weapons programs nor started developing and deploying space weapons. They have only tested basic capabilities. Why have no negotiations been initiated, and a bargain achieved, as the models in Figs. 12 and 13 would suggest possible? Why hasn’t conflict emerged, as the

model in Fig. 14 would indicate, due to the lack of a bargaining range?

The two bargaining ranges are possible, yet it depends on each state’s perceptions on costs and reliability of commitments. It should be noted that no single group in either China or the United States dominates the countries’ position and policies on space weapons.

However, debate in the United States on concerns over space debris has become more recognized and would place the recognition of the costs of space weaponization as higher than what the proponents of space weapons would disregard. One indication of this is the United States’ declaration that it will formally work with the European Union and other spacefaring nations to develop a non-binding international code of conduct for space activities. Secretary of State Hillary Clinton declared in January 2012 the U.S. position citing specifically that “The long-term sustainability of our space environment is at serious risk from space debris and irresponsible actors.” [40].

In a Senate Armed Services Subcommittee hearing reviewing U.S. space programs for 2013, Senator Jeff Sessions asked if U.S. participation in negotiating a code of conduct was driven mainly by concerns over debris, in which Assistant Secretary of Defense for Global Strategic Affairs Madelyn Creedon replied it was a major aspect of U.S. interest in negotiating the code [41].

Despite concerns over U.S. participation in a code of conduct raised by some U.S. senators that it would have treaty-like obligations which could hinder U.S. efforts in pursuing national interests and national security interests, as well as defending its space assets, there is common recognition among United States policymakers (military and political) on the need for some international agreed upon norms of behavior. The U.S. National Space Policy of 2010 highlighted the need to continue to develop standards to minimize debris, improve space situational awareness, and research means to preserve “the space environment for the responsible, peaceful, and safe use of all users.” [30]. Thus a current perception by many U.S. policymakers on the cost of weaponization, along with the concerns over regular debris generation from peaceful activities, would lie between points $P_{USA2} - a2$ and the status quo.

On China’s side there is also recognition of the problems of debris as it threatens its own satellites, but also that of other nations, which led to considerable international backlash and suspicion among these countries of Chinese ambitions with its 2007 ASAT test [42]. The consensus achieved within the United Nations Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, including China which in the past resisted discussions of a Code of Conduct for space, indicate a shift in the need for common “rules of the road.” [43].

Although strategy dictates an interest in investing in space weapons so as to be better prepared to counter the United States, or

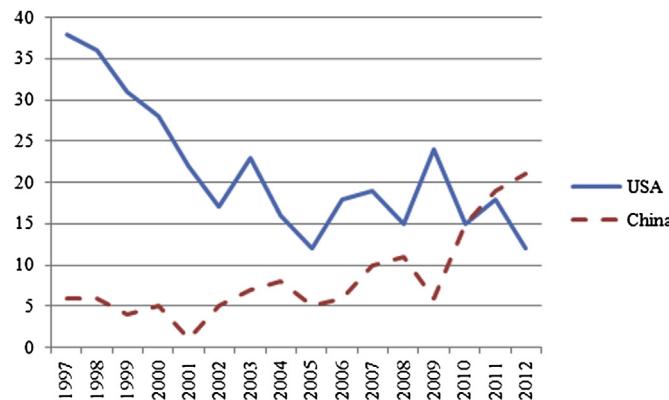


Fig. 11. U.S. and China orbital launches: 1997–2012.

Source: Numbers of U.S. and China orbital launches compiled by author from the Federal Aviation Administration’s *Commercial Space Transportation Year in Review*, “Worldwide Orbital Launch Activity” tables, reports from 1997 to 2012. Available at http://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/year_review/ (Accessed February 4, 2013).

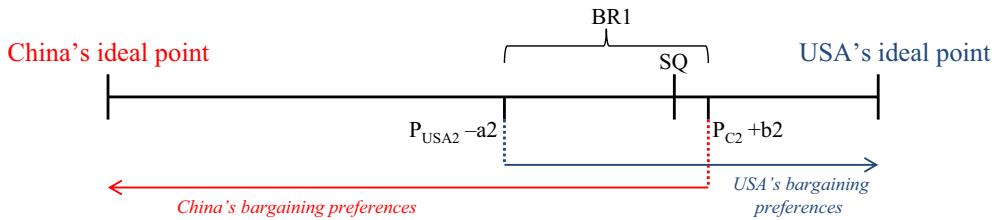


Fig. 12. Optimistic bargaining range.

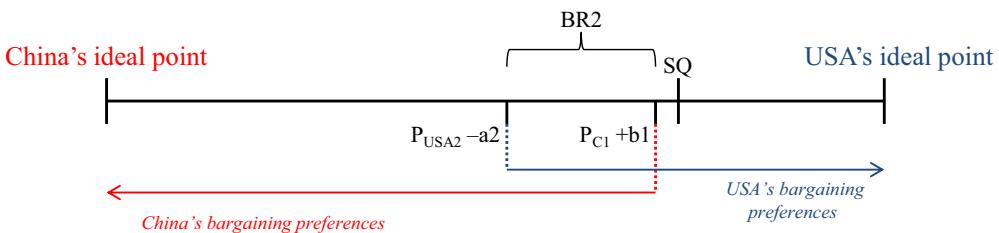


Fig. 13. Accommodation bargaining range.

at least degrade America's freedom of action in China's near abroad, the high costs of space systems may push China's consensus over costs between the status quo and $P_C + b_2$.

If these more cautious views on cost perceptions are adopted by both states (" $P_{USA} - a$ " for the United States and " $P_C + b$ " for China), recognizing the high costs of space weapons and perils of widespread orbital debris, a third possible bargaining range emerges (presented in Fig. 15).

This narrower bargaining range still permits the negotiation of an agreement, but since the status quo lies within it, there is no pressure by either side in establishing a space weapons agreement. The United States' position of primacy reinforces the view of U.S. advantages and the lack of need to cede its position as the status quo lies closer to its ideal point, and no interest in negotiating an agreement in which it would have to cede more to China than vice versa.

The United States benefits from this situation by still being able to test space capabilities without being restrained by any international agreements. China also benefits with the status quo as it is also granted conditions to research and test space weapons capabilities with no international legal restrictions, allowing it the possibility of a "breakout" capacity (quickly produce and deploy space weapons).

China's official foreign policy position advocates for international arms control agreements. In 2008, along with Russia, China introduced a draft *Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects* within the Conference on Disarmament. In 2010 China published a white paper affirming "The Chinese government has advocated from the outset the peaceful use of outer space, and opposes any weaponization of outer space and any arms race in outer space. China believes that the best way for the international community to prevent any weaponization of or arms race in outer

space is to negotiate and conclude a relevant international legally-binding instrument." [44].

Yet many analysts affirm that in case of conflict with the United States, Chinese space weapons would be its only advantage, therefore "China cannot be expected to trade away its counterspace capabilities for an arms-control regime that would further accentuate its competitors' military advantages." [22].

To skeptics of China's intentions the conditions which would allow China to prefer an arms control agreement in space would be if:

- China acquires the capacity to defeat the United States despite America's privileged access to space.
- The investments in Chinese counterspace begin to yield diminishing returns because the United States consistently nullifies these capabilities through superior technology and operational practices.
- China's own strategic and economic dependence on space intensifies to the point where the threats posed by any American offensive counterspace programmes exceed the benefits accruing to Beijing's own comparable efforts.
- Sino-American rivalry disappears entirely and the risks of war between China and the United States (or any other conventionally superior military power) approaches zero [45].

Some analysts argue that by addressing other issues (such as a resolution of the Taiwan issue) the need for space weapons and a U.S.–China competition in space could be avoided, while others argue China's capabilities are overhyped and certain assumptions over its intentions are not sufficient, or being misunderstood, to justify U.S. concerns [46]. Yet competing goals would remain, such as Chinese primacy in Asia, which would still offer incentives for China to invest in some capability to reduce U.S. advantages in



Fig. 14. U.S. space weapons proponent's view – no bargaining range.

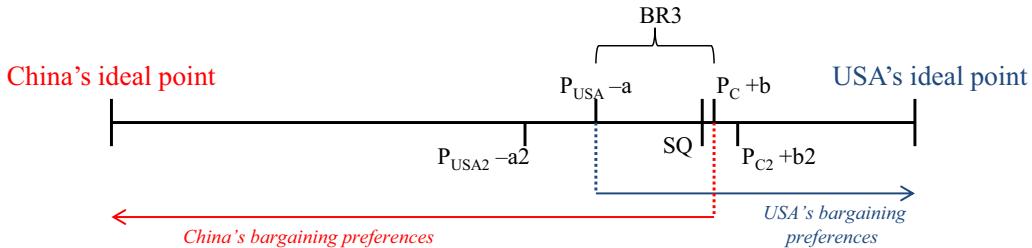


Fig. 15. Current bargaining range.

space. China has more incentives to be able to debilitate U.S. space based systems to eliminate its advantage [45], therefore the risk of a space arms race remains.

If China were to attempt weaponization at this time though, its gains would not be granted overnight. The United States would be able to present an agreement still within this bargaining range, but still close to the status quo, before such systems were tested and widely deployed. The United States could secure its interests by leading the establishment of “rules of the road” in space, agreements on proper conduct and the regulation of acceptable space weapons, such as those capable of blinding, dazzling, and jamming satellites over debris generating weapons, allowing the United States to leverage its technological superiority and still have its interests and position of primacy preserved.

Even regulating and permitting certain weapons at certain operating altitudes could be an option in delaying any benefits China could achieve by attempting a breakout space weaponization [47]. The United States would be able to mirror any Chinese initiatives and offer an agreement that would seek to preserve the disparity in power and capabilities. This hedging behavior by the United States could eventually alter the cost perceptions on each side, but it demonstrates how the United States would still be able to preserve its primacy, and how attractive the lack of a space arms agreement allows it the flexibility in maintaining that option.

Along with confidence building measures with allied and friendly nations and “public goods,” such as the tracking debris and increased space situational awareness, along with joint cooperation in clearing up debris could further reinforce the United States’ leadership in space and acceptance of its primacy and hedging strategy as it would be viewed as a responsible space power and custodian of space despite the lack of an agreement on space weapons.

There is also the possibility of a shift and convergence of interests between the United States and China. As both become more confident in their latent space weapons capabilities and confident of breakout capacity, they may establish an agreement so as to bar third parties from developing these capabilities. This would be of most interest to China as its increased power would lead some of its neighbors, such as Russia, Japan, India and South Korea, to also pursue space weapons capabilities to counter Chinese conventional and space advantages. This multilateral space race would not be in the United States’ interests as more space weapons capable states would increase the possibility of further threats and miscalculated actions that would increase orbital debris and further degrade the use of space.

The stability provided by maintaining the status quo within this favorable bargaining range, with a consensus perception of cost on both sides, allows the United States to continue to use space to its advantage and hedge against China by resisting any space arms agreements. This is possible because of the United States’ position of primacy.

4. Conclusion

Since satellites contribute to world prosperity, they offer more opportunities for cooperation and shared interests among states:

The more spacefaring nations become invested in satellites for economic growth, global commerce, and military capabilities, the more they will pause before opening Pandora’s Box [weaponization of space]. The constraints that worked against using satellites as target practice in the past are even stronger today. They will be stronger tomorrow, because dependency on satellites is growing in all spacefaring nations [48].

The concern over space debris may be a strong incentive for nations to resist the deployment of destructive space weapons. The United States, highly dependent on satellites, should welcome such an agreement, especially since its unrivaled global power projection capabilities and economic prosperity depend on satellites and are considered legitimate targets by potential rivals and adversaries in any future conflict. Yet it resists any agreement on space weapons.

Some analysts criticize U.S. concerns over its security as it remains the preeminent power. The United States cannot be threatened and should not fear a conventional war and invasion of its territory, and while terrorist attacks can be deadly and cause considerable damage, they do not pose an existential threat to the United States. The heightened sense of threat by the United States is a reflection of U.S. primacy, but may not be justified:

Policymakers would be wise to take account of Parkinson’s Law, the natural tendency to see more threats as power grows. In unipolar systems, the dominant state sees more monsters in need of destruction than do lesser states. Unnecessary ventures follow, accompanied by overextension, overspending and eventual decline. Perhaps this tendency to identify more threats as power increases is one of the natural leveling forces of international politics. Unless US leaders wish to see the unipolar moment end sooner than need be, they must recognize that the threats they perceive are generally less dire than they appear [49].

The need for a more “restrained grand strategy” could help preserve the United States’ position of primacy further, instead of inviting contestation and competition if it overextends itself reacting to every threat that emerges [50]. U.S. concerns over its space assets may be justified, but the means to protect them may require careful reflection and tempered initiatives, including the establishment of a space arms control agreement.

As DeBlois et al. emphasize, “Although the ability to deny adversaries the hostile use of space is critical for U.S. national security, the United States must be heedful of its unique vulnerability as the country with the most to lose in space.” [10]. This includes not only

tangible factors, such as number of satellites and economic revenue, but also intangibles such as international prestige, legitimacy and accepted leadership.

Through rationalist theory, or bargaining model, this article has presented the current state of affairs between the United States and China on space weapons and the potential (or lack thereof) of establishing a space arms control treaty. It has identified the perceptions of costs by proponents and opponents of space weaponization in the United States and China.

By determining these positions in various models, a final model was developed that notes a balanced consensus view on costs of weaponization that provides the conditions to establishing a space arms control agreement, but because of the United States' position of primacy and favorable position within the bargaining range, allows it to resist any agreements and adopt a hedging strategy in case China decides to initiate space weaponization. If such steps were taken, the United States would have time to offer a bargain to accommodate China's demands, but the agreement could still be close to the United States current favorable position. An agreement between these two powers could establish the basic norms on which a broader multilateral agreement could be negotiated on space weapons.

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